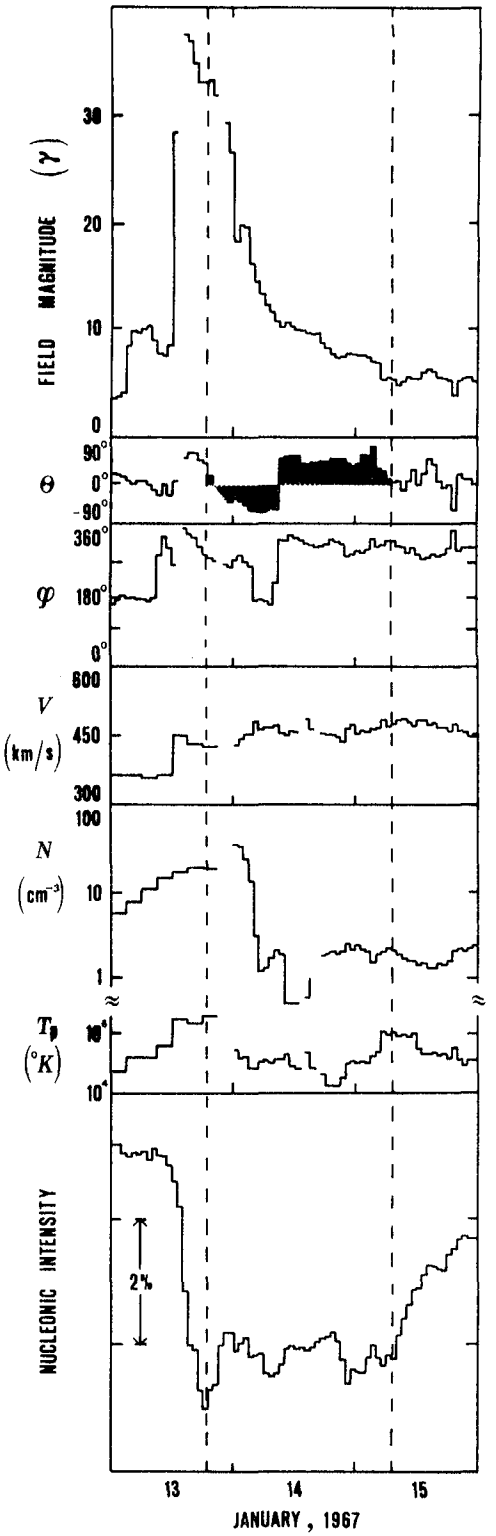
ANOMALOUS SHORT-TERM INCREASES IN THE GALACTIC COSMIC RAY INTENSITY: ARE THEY RELATED TO INTERPLANETARY MAGNETIC CLOUD-LIKE STRUCTURES ?

N. IUCCI, M. PARISI, C. SIGNORINI, M. STORINI and G. VILLORESI
Istituto di Fisica dello Spazio Interplanetario del C. N. R.
Dipartimento di Fisica - Università "La Sapienza"
Piazzale Aldo Moro, 2 - 00185 ROMA, ITALY

Thirty-one short-term increases (time duration < 24 hours and amplitude up to 5%) in the galactic cosmic ray intensity, occurring inside Forbush decreases events, have been identified over the period 1966 - 1977. These increases are highly anisotropic and occur after the compression region following the shock; the interplanetary medium /1/ is characterized by intense (≥ 10 nT) and higly fluctuating magnetic field $\vec{B}$, high velocity, low density and temperature (flare ejecta piston ?) as it can be seen in the examples given in Figures 1, 2, 3 and in the average behaviours of Figure 4. These $\vec{B}$-fluctuations seem to be ordered variations /2/ which could be representative of magnetic clouds /3/; this structure is particularly evident for the 7 cases given in the Table for which the data were always present and $\lambda_3 < 0.5\,\lambda_2$ and $\lambda_3/\lambda_2 \leqslant \lambda_2/3\lambda_1$ (for the definition of λ_1 see /2/); the average behaviour of these events is given in Figure 5. Also the large cosmic ray increase occurring on 17-18 September 1979, already analyzed by other authors /4, 5/, belongs to this category of events as it is shown in Figures 6, 7. In Figure 8 we show the time variations of $\vec{B}$ in the plane (X', Y') of maximum variance and in the plane (X', Z'), Z' being the minimum variance direction.

The analysis of these events is still in progress; the study of further events occurring during 1978 - 1979 and analytical refinement are necessary to understand the origin of the cosmic ray increases observed inside these magnetic clouds.

MAGNETIC CLOUD					ISOTROPIC C. R. INCREASE		
Start		Duration			Start		Amplitude
D - M - Y	H	(h)	λ_3/λ_2	λ_2/λ_1	D - M	H	(%)
23-09-66	21-22	18	.17	.50	24-09	00-01	1.5
13-12-66	20-21	26	.07	.48	14-12	02-03	2.3
13-01-67	19-20	36	.07	.56	13-01	19-20	1.0
29-07-67	20-21	10	.12	.34	29-07	21-22	1.5
24-03-69	17-18	20	.07	.35	24-03	23-24	1.3
09-11-69	04-05	14	.06	.62	09-11	04-05	2.1
15-05-72	20-21	12	.15	.49	16-11	01-02	0.6



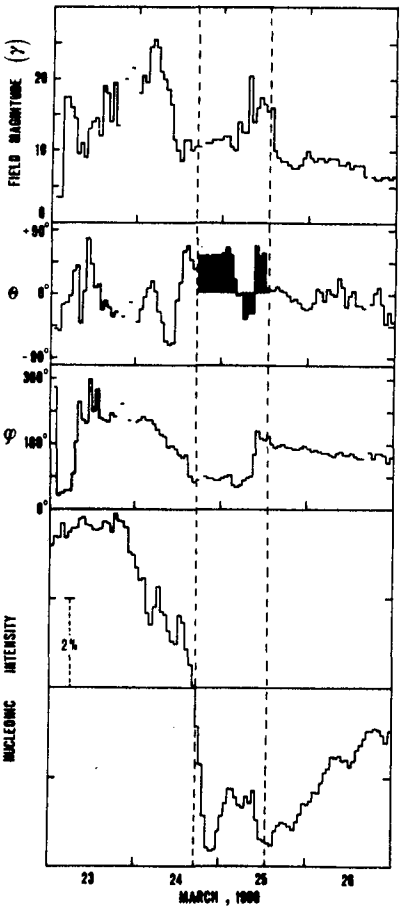


Figure 2 - (see Fig. 1)

Figure 1: Magnetic field, flow parameters and isotropic (average NM-64 intensity of Alert, Deep River, Goose Bay, Inuvik, Kerguelen, Kiel, McMurdo) nucleonic intensity associated with the magnetic cloud which is between the two vertical broken lines.

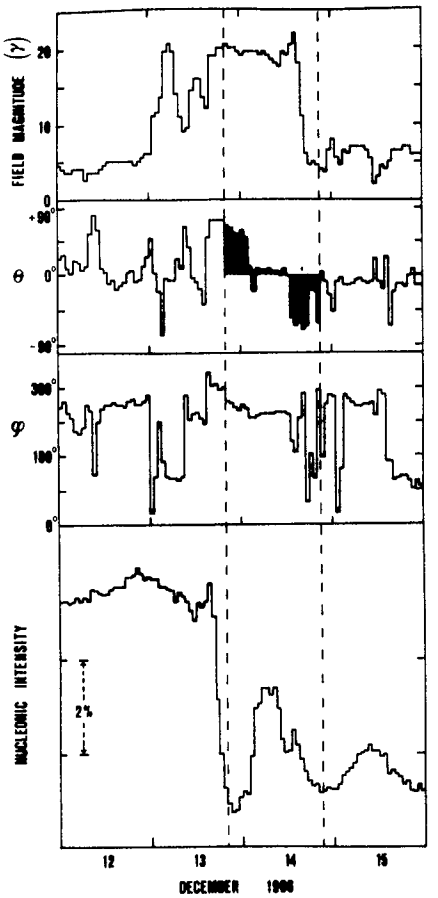


Figure 3 - (see Fig. 1)

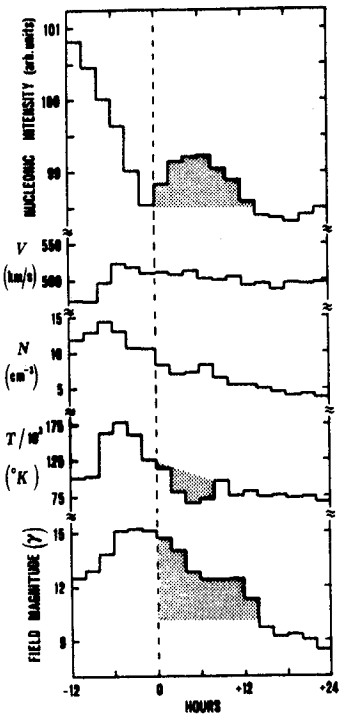


Figure 4

Figure 4: Superposed epoch analysis of interplanetary parameters and average (see the caption of Fig. 1) nucleonic intensity for 31 cosmic ray increases. The epoch time (zero hour) is the first hour of the increase.

Figure 5: a) The same as in Fig. 4 for 7 cosmic ray increases for which it was possible to identify the magnetic cloud structure.
b) The time durations of the 7 magnetic clouds relative to the epoch time are marked by horizontal bars.

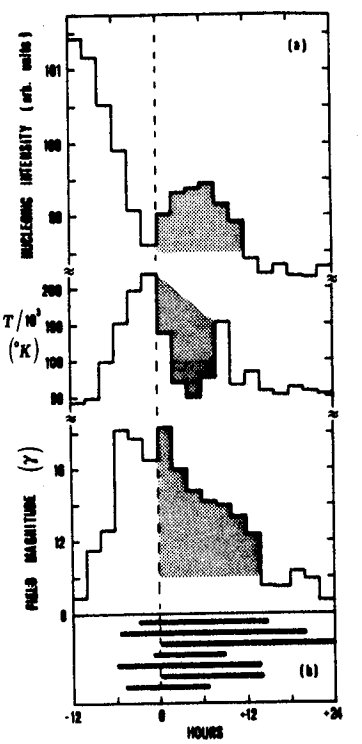


Figure 5

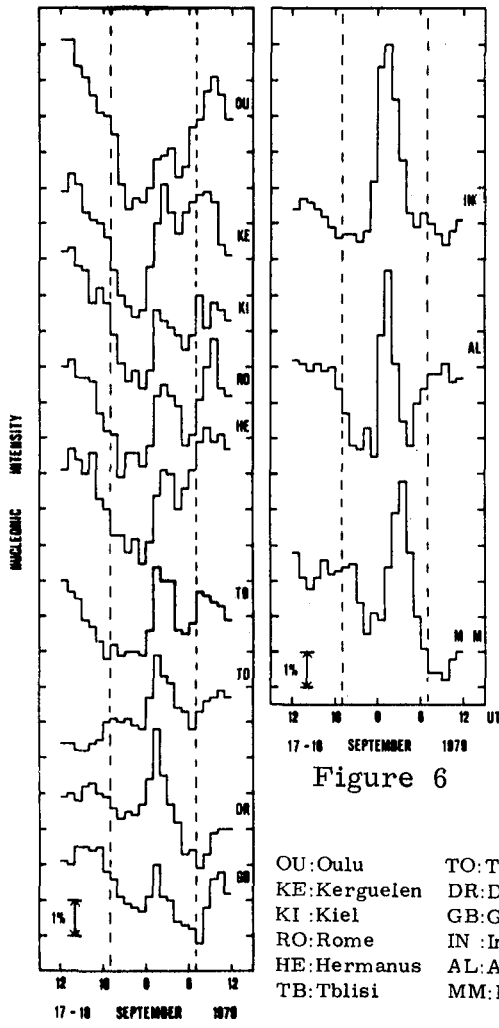


Figure 6

OU:Oulu TO:Tokio
KE:Kerguelen DR:D. River
KI :Kiel GB:G. Bay
RO:Rome IN :Inuvik
HE:Hermanus AL:Alert
TB:Tblisi MM:McMurdo

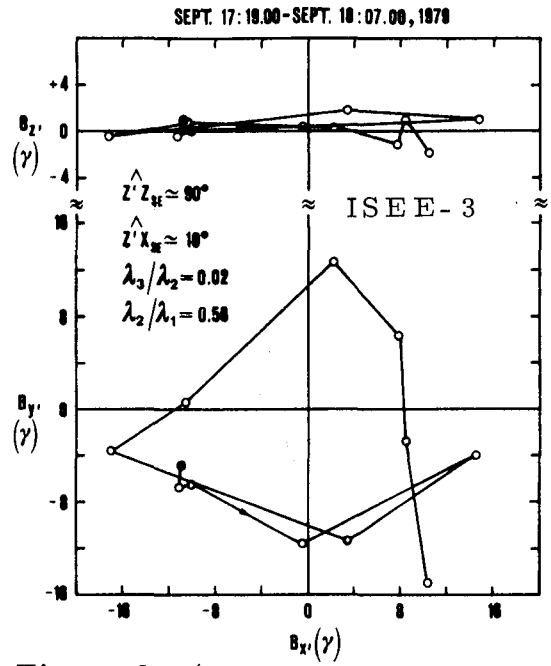


Figure 8 - (see the Text)

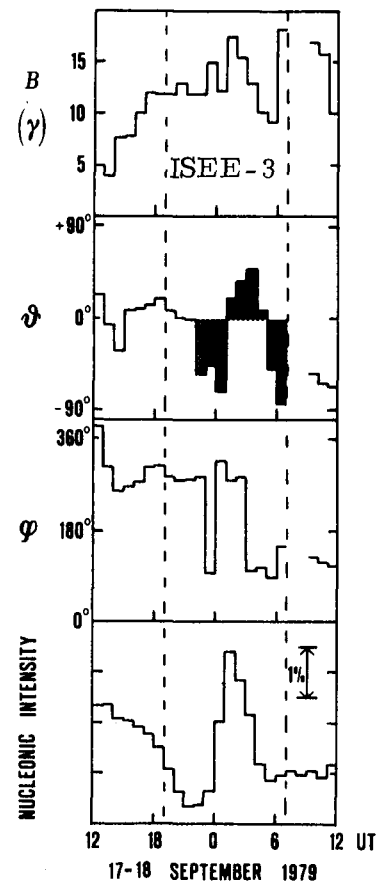


Figure 7 - (see Fig. 1)

References

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